ON THE GENUS *TETRACAMPOS*, WEDL, 1861

BY

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Genus *Tetracampos*, Wedl, 1861.

SYNONYMS :—*Ophryocotyle*, Southwell, 1913.
Gangesia, Woodland, 1924.

In 1861, Wedl described a cestode from a fresh-water fish under the name *Tetracampos ciliotheca* ; but he gave no definition of the new genus which he erected. Braun (1900) described the characters of the genus as follows :—

Head with four bothridia. Rostellum in the form of a cupola. On this rostellum there are four groups of nine hooks. The hooks are of unequal length, slightly curved, ending in a claw ; the longest hook is in the middle, the shortest hooks are at the sides of each group. Neck of average length ; four excretory canals to each segment. Genital pores on the flat sides. Egg thin shelled, containing a ciliated onchosphere.'

Type species :—*Tetracampos ciliotheca*, Wedl, 1861, from *Heterobranchus anguillaris*.

The following is an abstract of Wedl's description of the worm :—

Tetracampos ciliotheca (fig. 1).

Specimens of the above were found in the mucus from the intestine of *Heterobranchus anguillaris* (from the Nile) immediately below the stomach. They are delicate, thread-like worms 10 mm. to 15 mm. in length. The button-like head measures 0·2 mm. in breadth and is of a remarkable structure, recalling, by virtue of its ' lobes ' that of *Tetrabothrium*. Each ' lobe ' consists of parenchyma and is thin-walled and contractile, projecting as a flat disc. Anteriorly these lobes (bothridia of van Beneden) approach one another and encircle (surround) a projecting cupola-shaped armed papilla. The hooks, which may be differentiated into a long stalk with a short, slightly curved, pointed, sickle-shaped process or continuation, form four groups and are not arranged in circles or rows as in species of the genus *Taenia*. Each group generally consists of nine hooks, with the longest hook in the middle, and the shortest hooks at the outside of the group. A line drawn through the points of the hooks would describe an arc.

For a short distance behind the head, the segments are delicate, transparent, rounded off laterally, and connected to one another by well-developed longitudinal muscles. Two pairs of parallel vessels with transverse anastomosing branches run through the segments, and, in the head region, divide up into a complex network.

The last segment is cone-shaped (strobiliform) and possesses a distinct so-called ' porus excretorius.'

The genital pores are situated on the middle of the flat surface of each sexually mature segment. The eggs enclosing the hexacanth embryo are peculiar. Eggs were taken from the last segments and kept under observation, and it was noticed, after the external egg-skin had burst open, that the internal covering was furnished with comparatively long cilia, which were in rapid movement; these produced not only a rotatory but also a forward movement.

(Wedl at first doubted this phenomenon, but after observing many eggs, satisfied himself that the embryophore was ciliated.)

The anatomy of the worm was not described, but the essential features of the species are the presence of an armed rostellum and the fact that the embryophore is ciliated. It is impossible to decide from Wedl's figure and descriptions whether the so-called ' bothridia ' are really outgrowths from the head, or whether they are true acetabula.

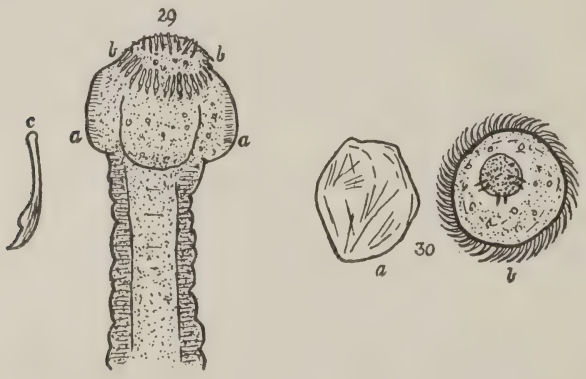

Fig. 1. *Tetracampos ciliotheca*, after Wedl. Magnification unknown.
(29) Head. *a.a.*—bothridia; *b.b.*—the four groups of hooks; *c.*—an isolated hook; (30) *a.*—external egg-shell; *b.*—internal ciliated egg-shell with embryo.

Wedl states that the genital pores are situated on the flat surface of the worm (i.e., ventrally), but it appears probable that the sexual apertures are situated laterally, and that the apertures to which he refers are secondary pores, caused by the dehiscence of the gravid uterus.

It is to be noticed that the worm was obtained from the intestine of a fresh-water cat-fish (*Heterobranchus anguillaris*). The adult

cestode parasites most common in fresh-water fishes belong to the genus *Proteocephalus* (Weinland, 1858) La Rue, 1914.

La Rue (1914) ascribed the following characters to the family PROTEOCEPHALIDAE :—

'Heads small. Suckers sessile and without accessory areola. Fifth sucker functional, vestigial, or lacking. No rostellum. Genital organs as in other Tetraphyllideans. Genital pores marginal, irregularly alternating. Vitellaria lateral, follicular, follicles closely grouped about a central conducting tubule. Ovary bilobed, posterior. Oöcapt, oötype, shell gland, uterine passage present. Uterus with lateral outpocketings and one or more preformed, ventral, uterine openings. Vitellaria, testes, ovary and uterus *within* the inner longitudinal muscle sheath.

'Habitat.—In fresh-water fish, amphibia, and aquatic reptiles.'

La Rue defined the genus *Proteocephalus* as follows :—

'With the characters of the family.

'Head globose or conical, flattened dorso-ventrally. No rostellum. No spines or hooks. No fold of tissue encircling base of head or enfolding suckers. Suckers circular or oval. Fifth sucker functional or vestigial, rarely lacking. Testes in a broad field between vitellaria. Parenchyma with close meshes. Musculature well developed. Eggs with three membranes. Habitat :—In fresh-water fish.'

It is clear that, owing to the presence of an armed rostellum, *Tetracampos ciliotheca* cannot be referred to the genus *Proteocephalus* as defined above, but, as other authors have since recorded similar worms with an armed rostellum and possessing an internal anatomy typical of the genus *Proteocephalus*, it is most probable that the internal anatomy of Wedl's specimen was also typical of the genus *Proteocephalus*.

As a result, it is necessary to emend the characters of the family so as to include within it a genus with an armed head.

The writer in 1913 described as follows a worm which should clearly be referred to Wedl's genus *Tetracampos* :—

Ophryocotyle bengalensis, Southwell, 1913 (fig. 2)

'Over sixty specimens of this worm were obtained from the intestine of *Ophiocephalus striatus*, and a few were also obtained from the intestine of *Labeo rohita*. Both fish were caught at Berhampur Court, Bengal, in a fresh-water tank. This genus of tapeworm usually occurs in birds, and considerable interest attaches to the presence of these adult forms in Teleosts. The average length of the worms was 7·5 mm. Greatest breadth (at posterior end), 0·8 mm. These latter segments were from four to five times broader than long. The head consists of four cup-shaped suckers, directed slightly forward. Anteriorly the head terminates in an umbrella-shaped protrusible rostral disc whose circumference is armed with a large number of hooks arranged in two rows. The exact number could not be determined,

as, in removing the parasites from the intestine of the fish, many of the hooks had been torn away. The exact number counted in three specimens is given in the following table :—

(i) One row of twenty-five hooks.
(ii) Two rows with a total of fifty-three hooks.
(iii) Two rows with a total of fifty-two hooks.

'The hooks appear to be all similar. They have broad bases and are sharply recurved in profile. Viewed end on, they appear elongated.

'The suckers are armed with exceedingly minute spines which appear to be limited to their anterior borders. The head measures about 0·5 mm. broad. The neck is fairly long, measuring 2·7 mm. Dots of black pigment are scattered about over the whole worm. The first proglottides are exceedingly shallow, and *all* proglottides are broader than long. The lateral margins are wrinkled in such a way that in young specimens the true strobilization can only be determined under a lens. The genital apertures are lateral and are almost all on one side.

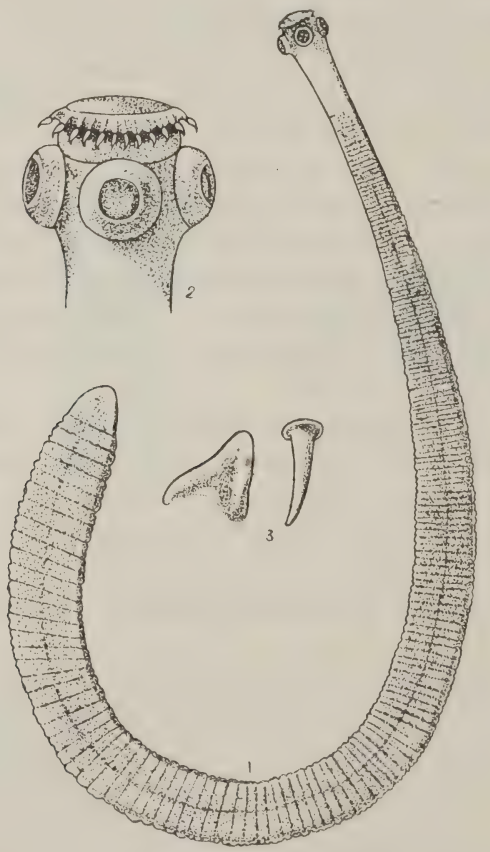

Fig. 2. *Tetracampos bengalensis* (Southwell) = *Gangesia wallago*, Woodland. (1) Entire worm. × about 30. (2) Head. × about 180. (3) Hooks greatly enlarged. After Southwell.

'The uterus appears to be made up of a number of rounded egg capsules scattered about the proglottid.

'Habitat :—The intestines of *Labeo rohita* and *Ophiocephalus striatus*, Berhampur Court, Bengal, June, 1912. About sixty specimens.

'Amongst the worms just described were two large specimens measuring 27 mm. and 22 mm. respectively. They differ from the smaller forms only in having the neck very much shorter and in being much larger. Two rows of about fifty hooks were counted round the circumference of the rostral disc.'

A re-examination of a single specimen of this species (the only one now in the writer's possession) has brought to light the fact that the internal anatomy of the worm is exactly similar to that found in species of the genus *Proteocephalus*.

The hooks on the head are all alike and are in a *single* crown as originally figured; they measure about 35 μ. The uterus is rudimentary and does not contain egg capsules as suggested in the above description.

Although the species is clearly to be referred to the genus *Tetracampos* it is undoubtedly different from *T. ciliotheca*; for, in *O. bengalensis*, the rostellum is armed with a crown of hooks, all of which are similar, whilst in *T. ciliotheca* the rostellum is armed with four groups of hooks which are not uniform in size.

Woodland (1924) has just described two species of cestodes, viz., *Gangesia wallago* and *G. macrones* from India, obtained from the intestines of *Wallago attu* and *Macrones seenghala* respectively, for which he erects a new genus with the following characters :—

'*Gangesia* :—with the characters of the family PROTEOCEPHALIDAE but emended to include forms with armed rostella. With a scolex possessing a globose muscular rostellum armed or unarmed, and no fifth sucker. The suckers may or may not bear spinelets. Testes in a single broad field between vitellaria. Eggs with three membranes. Habitat :—In fresh-water fish.'

Woodland described the two species as follows :—

G. wallago, Woodland, 1924 (fig. 3).

'Length of strobila usually not exceeding 40 mm., with a maximum breadth of about 1·5 mm. Proglottides numerous, well over 100 in number in mature forms, narrow antero-posteriorly in front but square or elongated posteriorly. Segmentation distinct. Scolex 0·166 to 0·232 mm. long and 0·298 to 0·448 mm. broad. Suckers with projecting edges, 0·120 to 0·172 mm. broad, and in part bearing numerous closely-set spinelets. The globular rostellum bears a single circle of hooklets, all of one kind, 29·28 to 43·92 microns long and twenty-eight to forty-two in number. A very short neck is present, but is only visible in specimens with the scolex torn off or in flattened specimens, and gradually increases in diameter up to the first traces of segmentation. Genitalia like those of *Proteocephalus*. Uterine diverticula twenty to twenty-eight in number. Testes over 100 in number,

65·8 to 109·8 microns in length and maximum breadth of 28 microns. Genital openings lie a little in front of the middle transverse line of the proglottid, and the cirrus sac and vaginal openings vary as to which is anterior. The uncontracted cirrus sac extends over about one-third of the distance across the proglottis. Eggs provided with three membranes, the outermost being 91·5 to 98·8 microns in diameter and the spherical embryo measuring 18·30 to 21·96 microns. Habitat :— intestine of *Wallago attu* Bleek (and probably *Ophiocephalus striatus* and *Labeo rohita*), rivers of India.'

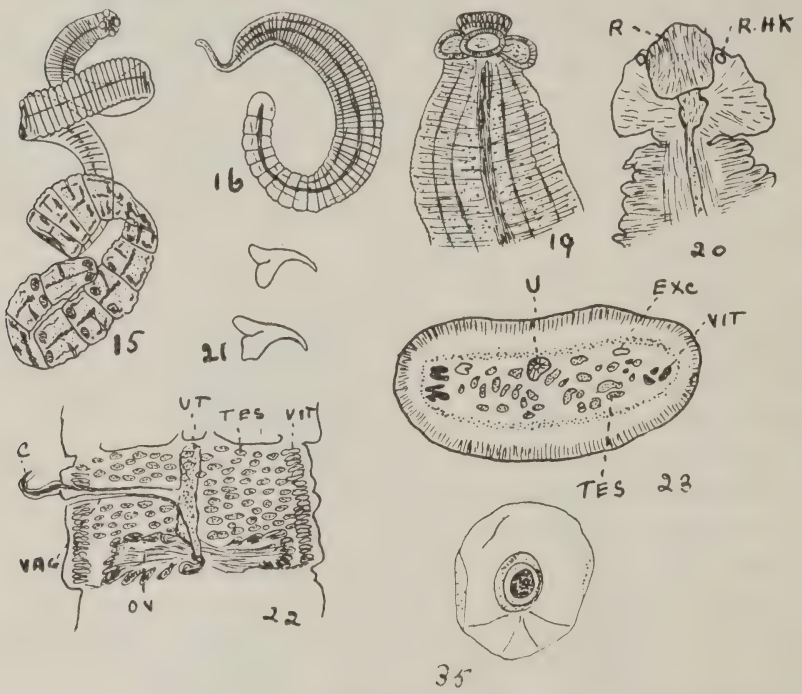

FIG. 3. *Tetracampos bengalensis* (Southwell, 1913)=*Gangesia wallago* (Woodland, 1924). (15) A mature worm (actually about 12 mm. long) with scolex. × 12. (16) A small worm (actually about 4 mm. long) with scolex torn off and showing the drawn-out short neck. × 12. (19) Scolex with rostellum and suckers protruded and a slight indication of the short contracted neck. × 39. (20) Longitudinal section through scolex to show the limits of the muscular rostellum. × 87·5. (21) Two hooks from the rostellum. × 260. (22) Flattened mature proglottid. × 27·5. (23) Transverse section through a mature proglottid just behind the level of the cirrus sac. × 56. (35) Egg (fully developed) from contents of the fish intestine. × 180. *r.*—rostellum ; *r.h.k.*—rostellar hooks ; *u.*—uterus ; *exc.*—excretory canal ; *vit.*—vitellaria ; *tes.*—testes ; *vag.*—vagina ; *ut.*—uterus ; *ov.*—ovary ; *c.*—cirrus. After Woodland.

G. macrones, Woodland, 1924 (fig. 4).

' Length of strobila does not exceed 60 mm. in length, with a maximum breadth of about 1·2 mm. Proglottides numerous, between 150 and 200 in number in mature worms, very narrow antero-posteriorly in front but square or elongated posteriorly. Segmentation distinct. Scolex measures about 109 microns long and 193 microns broad. Suckers small and thick-walled, about 67 microns broad

and bearing numerous closely-set spinelets on their upper edges and adjacent internal surfaces. The globular rostellum (about 109 microns in diameter) bears a single circle of hooks, of two kinds, large (11·0 to 14·6 microns long) and small (about 6 microns long) alternating. Neck absent. Genitalia like those of *Proteocephalus*. Uterine diverticula twenty to thirty in number. Testes over 100 in number. The genital apertures lie in front of the middle transverse line of the proglottid and usually the cirrus sac opening is anterior to the vaginal but the reverse condition also occurs. The uncontracted cirrus sac in flattened specimens extends over only from one-sixth to one-quarter of the breadth of the proglottis. Habitat :— Intestine of *Macrones seenghala* Sykes, from rivers of India.'

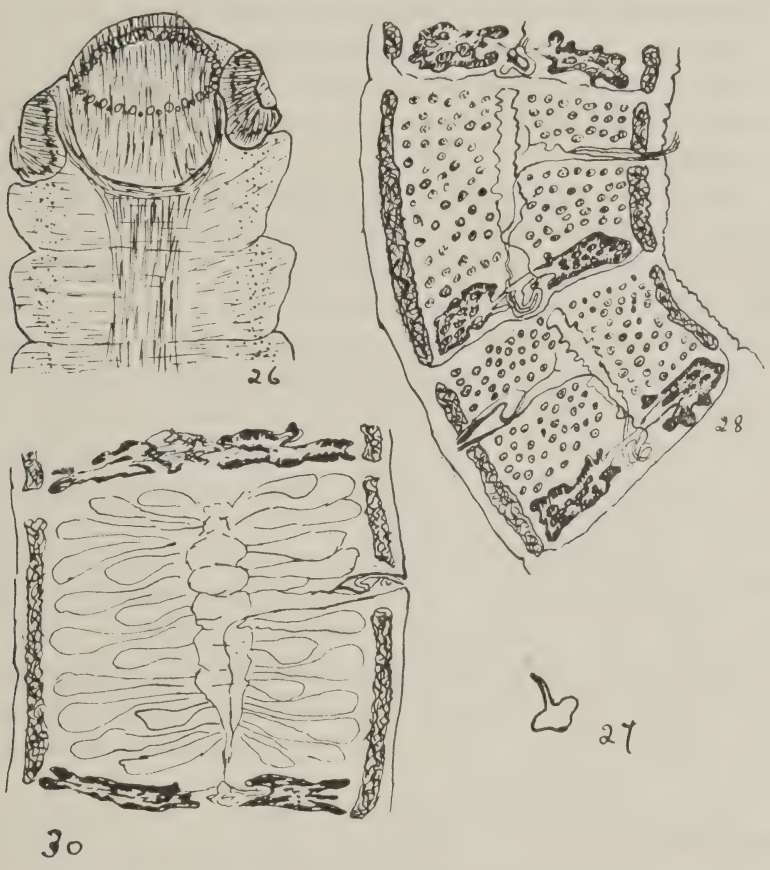

FIG. 4. *Tetracampos macrones* (Woodland, 1924)=*Gangesia macrones*, Woodland, 1924. (26) Scolex viewed in optical section. × 180. (27) Rostellar hook. × 530. (28) Mature flattened proglottids (both cirrus sacs have been drawn too long, judging from later measurements). × 17·5. (30) Sketch of a gravid proglottid with outlines of fully developed uterine diverticula (full of eggs in actual preparations). The central stem of the uterus is considerably flattened. × 17·5. After Woodland.

As all the preceding species possess an armed rostellum and are found in fresh-water cat-fish there can be no doubt that they are all to be referred to Wedl's genus *Tetracampos*, which, as Braun's description is inadequate, is now redefined as follows:—

PROTEOCEPHALIDAE. *Body segmented; head with four suckers, and armed with hooks. Internal anatomy as in the genus Proteocephalus, La Rue. Genital pores marginal and irregularly alternate. Adults parasitic in fresh-water fishes.*

Woodland proposed emending the characters of the Order *Tetraphyllidea*, Lühe, 1910, and of the Family PROTEOCEPHALIDAE, La Rue, 1914, in order to include the forms which possess an armed rostellum. Apparently it did not occur to him that cestodes whose heads are armed with four suckers probably belong to the Order *Cyclophyllidea*.

Prior to the appearance of Woodland's paper, the writer had already made an exhaustive study of the worms included in the Order *Tetraphyllidea* and had arrived at the conclusion that the order should be limited so as to include only species in which the head bears four bothridia (lappet-like outgrowths from the head).

The family PROTEOCEPHALIDAE, which possesses four suckers, or acetabula, falls naturally into the *Cyclophyllidea*, but differs from most other families of that order in having numerous vitelline glands situated laterally, instead of being condensed into a single mass in the vicinity of the ovary.

The *Cyclophyllidea* were accordingly split up by the writer into two sub-orders, viz.: (1) the *Univitellata*, comprising all those forms with four suckers, and in which the vitelline glands are condensed into a single mass; and (2) the *Multivitellata*, comprising all other forms with four suckers, in which the vitelline glands are either situated laterally or extend over the dorsal and ventral surface of the worm.

Wedl's genus *Tetracampos* is referred to the sub-order *Multivitellata*. As Braun, however, stated that the head was armed with four bothridia, the writer in his Monograph dealt with it under the Family ONCHOBOTHRIIDAE. The genus clearly belongs to the Family PROTEOCEPHALIDAE, La Rue, 1914, which is emended accordingly as follows:—

Body segmented; head small, bearing four suckers (acetabula) and either armed or unarmed. Fifth sucker functional, vestigial or

lacking. Genital pores marginal and irregularly alternate. Vitellaria lateral or extending over the dorsal and ventral surfaces ; Uterus with lateral outpocketings and with one, or more, preformed, ventral uterine openings. Habitat :—In fresh-water fish, amphibia and aquatic reptiles.

The genus *Tetracampos*, Wedl, 1861, is thus referred to the Family PROTEOCEPHALIDAE (La Rue, 1914) emended ; this family is placed in the sub-order *Multivitellata*, Southwell, 1925, of the Order *Cyclophyllidea*, Southwell, 1925.

The genus at present contains three species, viz. :—

(1) *Tetracampos ciliotheca*, Wedl, 1861.

(2) *Tetracampos bengalensis* (Southwell, 1913).

SYNONYMS :—*Ophryocotyle bengalensis*, Southwell, 1913.
Gangesia wallago, Woodland, 1924.

(3) *Tetracampos macrones* (Woodland, 1924).

SYNONYM :—*Gangesia macrones*, Woodland, 1924.

Woodland points out that the specimens of *O. bengalensis* Southwell, 1913, are ' almost certainly examples of *G. wallago*,' but

' I think Southwell's wholly insufficient description of his *Ophryocotyle bengalensis* justifies me in not adopting his specific name for my type species of *Gangesia*. Only an adequate statement of distinctive characters can justify claim to priority.'

As the description of *O. bengalensis* was sufficient to enable Woodland to state that his *G. wallago* is almost certainly the same, there is obviously no justification whatever for burdening the literature with other names. Under the ordinary rules of nomenclature, *Gangesia wallago* becomes a synonym of *Tetracampos bengalensis* (Southwell, 1913).

The writer is indebted to the Editor of *Parasitology* for permission to reproduce the descriptions and figures of *Gangesia wallago* and *G. macrones*.

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